

Massachusetts “Stretch” Energy Code

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What affects energy use?

- Size of building (external surface area)
- Air leakage – through holes in attic, walls, basement ceiling, heat/AC ducts and pipes
- Heat transfer through solid materials – can reduce with insulation
- Efficiency of equipment: heating and cooling systems, appliances, lighting

MA Building Code

- Uniform 'State-Wide' Code in place since '75
 - Board of Building Regulation and Standards (BBRS) oversees the code; changes, appeals, etc.
- Pertains to all buildings in state; two volumes:
 - *One- and Two-Family Dwelling Code* and
 - *Basic Code* for all other buildings
- Enforcement by municipal building officials
- Scope, including but not limited to:
 - Fire Protection
 - Structure
 - HVAC
 - Plumbing, Electrical
 - Energy Conservation

New Mass. Base Code

- Green Communities Act (2008) requires that Mass. adopt the latest version of the International Energy Efficiency Code (IECC) within one year of publication
- BBRS will adopt 2009 IECC early in 2010
- For commercial buildings, IECC is similar to ASHRAE 90.1 standard



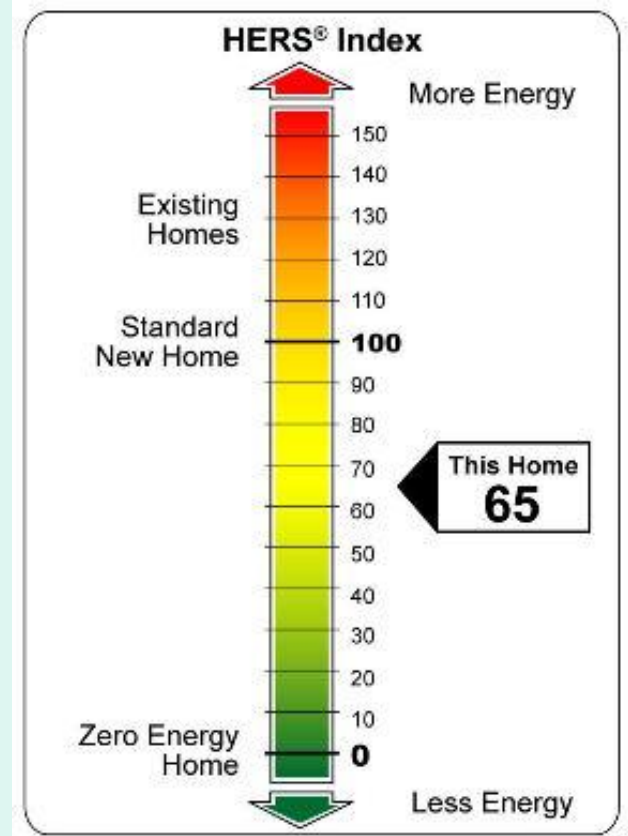
Residential stretch code based on 'Energy Star'

- Proven cost-effective program
 - 15% of new construction in MA
- Builder incentives/rebates
 - \$1250/home for HERS 65
 - Rebates on appliances,
heating and cooling, lighting, etc.
- Builder training and materials
- Subsidized HERS raters



Residential New Construction

- Performance only 'stretch' option
 - Uses [Home Energy Rating System](#) (HERS)
 - 70 or less < 3,000 sq ft.
 - 65 or less > 3,000 sq ft.
- Requires a certified HERS rater
 - Review building plans
 - Check insulation installation
 - Blower-door and duct testing



Efficiency steps to reach HERS 60

- Conditioned basement (heat/AC)
- Foundation walls R10 insulation
- Above-grade walls R22 insulation
- Window U-factor 0.33 (heat loss rating)
- Attic ceiling R38 cellulose insulation
- Slope ceiling R32 cellulose insulation
- Air leakage: 4 air changes/hour at 50 Pascals pressure (created by high-power fan)
- Natural gas furnace 0.94 AFUE (annual fuel utilization efficiency), 65 kBtu/hour capacity
- Central Air Conditioner - 3 ton 15 SEER (efficiency)
- Domestic Hot Water - 0.62 efficiency natural gas tank
- Programmable thermostat
- 75 percent fluorescent lighting

Cash-Flow for HERS 60 new home: 2,672 square feet, 3 bedrooms

- Improvement Costs \$ 8,103
- Mortgage Interest Rate 5%
- Loan Term (Years) 30
- Annual Incremental Mortgage Payment \$527
- Annual Energy Costs \$ 3,103
- Annual Energy Savings from Baseline \$1,364
- **Annual Cash Flow Gain \$ 837**

Commercial Stretch Code Requirements

Building category	Definition	Requirements based on energy performance (can do prescriptive instead where shown)	Alternative “prescriptive” requirement – specific efficiency measures
Large commercial and large residential multi-family	Commercial above 100,000 ft ² ; residential 4 stories or more and 100,000 ft ²	Energy use 20% below ASHRAE 90.1 2007, determined by modeling	None
Medium commercial and residential multi-family	Commercial 5,000 to 100,000 ft ² , residential 4 stories or more and below 100,000 ft ²	Energy use 20% below ASHRAE 90.1 2007, determined by modeling	IECC 2009 with NBI Core performance: improved air sealing, insulation, lighting, etc.

Advanced Building Features

- High Efficiency T-5 Pendant Lighting
- Lighting Control Efficiency
- Reduced Lighting Power Density
- Efficient Site Lighting
- Additional Wall Insulation
- High Performance Glazing
- Efficient VAV RTU's, with ECM Motors
- Demand Control Ventilation
- Part Load HVAC Efficiency Enhancements

Funded Utility Services Support

- Early Life Cycle Cost Analysis
- Integrated Design Team Approach
- Commissioning

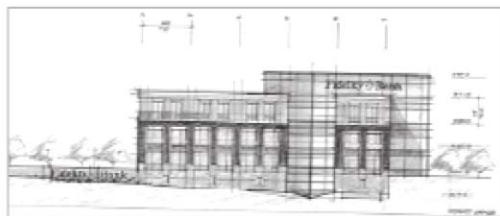


Project Description

The 47,000 SF Fidelity Bank Corporate Office and Branch was constructed as a design-build project in Leominster, MA. The four story building will provide office space plus a ground floor branch bank office. This project is acclaimed for its highly successful implementation of the national Advanced Buildings program. The project demonstrates the validity of the Advanced Buildings program assertions. The guideline cost effectively delivered even more than the expected 20% to 30% reduction in annual energy costs compared to a code based design.

Envelope Improvements

- Walls: Added 3-1/2" batt insulation to planned 2" rigid.
- Glazing:
 - Upgrade U value from 0.42 to 0.31
 - Upgrade SHGC from 0.50 to 0.30
- Projected envelope savings: \$1,500



Project Team

Owner:
Fidelity Bank
Project Management:
Habitat Advisory Group



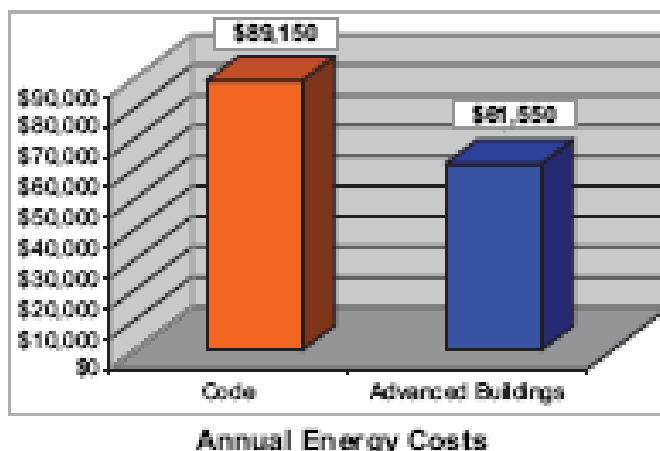
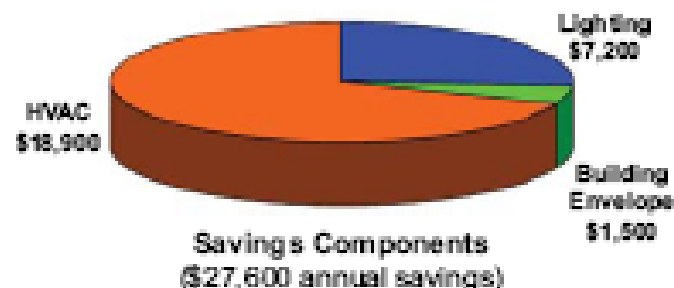
High Performance Building Design Uses 31% Less Energy

Savings Projection

Annual Energy Savings:	\$ 27,600
Additional Cost for Upgrades:	\$100,622
Utility Incentives:	<u>- \$ 66,587</u>
Net Owner Costs:	\$ 34,035

Payback with Incentives:	1.2 years ROI: 83%
Payback without Incentives:	3.7 years ROI: 27%

31% Improvement Over Code



Lighting Savings Summary

The lighting layout consisted mainly of T-5 pendants in open office areas, and the latest generation of recessed T-5 fixtures in the remaining areas.

Projected Lighting Savings: \$7,200



	Mass Energy Code	Advanced Buildings Criteria	Final Design	% Reduction
Lighting Power Density	1.34 w/SF	0.96 w/SF	0.86 w/SF	36%

Improved lighting quality while using less energy!

Building category	Definition	Requirements based on energy performance (can do prescriptive instead where shown)	Alternative “prescriptive” requirement – specific efficiency measures	Source, comments	Benefit-cost modeling results
New residential	Single-family, multi-family of 3 stories or less	HERS index 65 above 3,000 ft2, 70 below 3,000 ft2, certified by HERS rater; follow Energy Star thermal bypass checklist	None	HERS rating = energy use as % of use under IECC code. Current Mass. code ~ HERS 99; soon-to-be-adopted IECC 2009 ~ HERS 92	Sample 3 bedroom home, estimate \$837/year savings (\$8,103 extra construction cost = \$527/year higher mortgage, but save \$1,364/year energy costs)
Residential additions	Expansions of existing living space	HERS 65 over 3,000 ft2, HERS 70 below 3,000 ft2; certified by HERS rater (or can choose prescriptive option at right)	Prescriptive option of Energy Star Homes program - same as residential rehab below		3-bed home, estimate \$40/year savings (\$10,168 extra construction cost = \$661/year, but energy costs \$701/year lower)
Major residential rehab/ alterations	Major alterations as in existing code – excludes storm windows, reroofing, doors, etc.	HERS 80 over 2,000 ft2, HERS 85 under 2,000 ft2; certified by HERS rater (or prescriptive option)	Prescriptive option of Energy Star Homes program; insulation equal to IECC 2009 for climate zone 5	Quality air-sealing and insulation, EnergyStar windows	
Large commercial and large residential multi-family	Commercial above 100,000 ft2; residential 4 stories or more and 100,000 ft2	Energy use 20% below ASHRAE 90.1 2007, determined by modeling	None	DOE, NGRID modeling show energy savings greater than 20%	
Medium commercial and residential multi-family	Commercial 5,000 to 100,000 ft2, residential 4 stories or more and below 100,000 ft2	Energy use 20% below ASHRAE 90.1 2007, determined by modeling	IECC 2009 with NBI Core performance: improved air sealing, insulation, lighting, etc.	Prescriptive based on New Buildings Institute program; used by utilities now for incentive programs	NGRID, NSTAR case studies. Example – 60,000 ft2 office bldg., \$91,000 extra cost, \$29,500 annual energy savings; and \$63,100 NGRID rebate
Small commercial	Below 5,000 ft2	Exempt	Exempt		
Specialty commercial	Supermarkets, labs, warehouses below 40,000 ft2	Exempt	Exempt	Other specialty buildings can apply for waiver	
Commercial alterations		Exempt	Exempt		